

Description of a New Species of Butterflyfish, *Roa australis*, from Northwestern Australia (Pisces: Perciformes: Chaetodontidae)

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ABSTRACT. A new species of butterflyfish (genus *Roa*) is described from the North-West Shelf of Western Australia and the Arafura Sea. *Roa australis* n.sp., the only known species of the *Roa modesta*-complex in the southern hemisphere, is most similar to *Roa excelsa* from the Hawaiian Islands, differing from it most noticeably in having narrower and fainter brown bars, white instead of brown anterior dorsal spines, and subequal 3rd and 4th dorsal spines rather than a distinctly longer 3rd spine.

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The new species and three close relatives comprise the small Indo-Pacific genus *Roa* (Jordan, 1923), and as a group they are often referred to as the “*modestus* species complex” of the genus *Chaetodon*. They have widely separated distributions: *R. jayakari* (Norman, 1939) occurs in the northwestern Indian Ocean from the west coast of India to the Red Sea; *R. excelsa* (Jordan, 1921) is known from the Hawaiian Islands and Guam; *R. modesta* (Temminck & Schlegel, 1844) occurs in subtropical waters of Japan, ranging south into the China Seas, Taiwan and the Philippines. Records of *R. modesta* from northwestern Australia are based on the new species *R. australis*. The species of this small butterflyfish genus are normally confined to moderate depths, usually in excess of 100 m, and reported to almost 300 m. Only *R. modesta* regularly enters shallow depths in Japanese waters. *Roa excelsa* has been reported as shallow as 20 m in Hawaii (Allen *et al.*, 1999), but the species normally lives at depths greater than 100 m. *Roa jayakari* has been photographed from a submersible in the Red Sea at a depth of 180 m (Kuiter, 2002), and an unidentified species of butterflyfish, photographed from a submersible in the Comoro Island at

about 200 m, although differently coloured, may belong to this genus (Kuiter, 2002). The four species share a banded pattern of alternating broad brown and pale bands, and have a distinctive, about eye-sized, black spot on the soft dorsal fin. All have been referred to *Roa modesta* (or, more often as *Chaetodon modestus*) by various authors, because the various species are so similar.

In contrast to most other butterflyfishes, that are popular with divers and aquarists, the species of *Roa* have received little attention. Specimens are generally collected by trawl and are of no interest to fisheries, and regarded as a trash species. In compiling information for a book on the butterflyfishes of the world (Kuiter, 2002), it became clear that there was a great deal of confusion about the identities of this small group of butterflyfish species referred to as the *modestus* species complex. Most authors have considered Jordan’s genus *Roa* to be, at best, a subgenus of *Chaetodon* Linnaeus. Blum (1989), however, reinstated *Roa* to generic status, based on an unpublished cladistic analysis in his PhD thesis. Ferry-Graham *et al.* (2001) reanalysed Blum’s previously unpublished data, and agreed that *Roa* was a monophyletic group of 3 species distinct from

Chaetodon: however they chose not to recognize this in their classification and listed *Roa* as subgenus of *Chaetodon*. In contrast, Pyle (2001) and Kuitert (2002), recognized *Roa* at the generic level based on Blum's analysis, and this is followed here in the present paper describing a new species.

Methods

General terminology and methodology follows that of Kuitert & Debelius (1999). Institutional acronyms follow Leviton *et al.* (1985). The Diagnosis refers to the holotype only, whereas the Description includes the paratypes.

Roa australis n.sp.

Fig. 1; Tables 1, 2

Chaetodon modestus (non Temminck & Schlegel, 1844); Gloerfelt-Tarp & Kailola, 1984: 220; Sainsbury *et al.*, 1985: 245.

Type material. HOLOTYPE: WAM P.26215-001 (1, 112 mm SL) off Port Hedland, Western Australia, 18°24'S 119°02'E, 140 m, Sainsbury *et al.*, 29 May 1978. PARATYPES: AMS I.21835-018 (14, 69.5–81 mm SL) Arafura Sea, Northern Territory, from 09°21'S 133°12'E to 09°22'S 133°10'E 156–164 m, CSIRO Soela, Otter trawl, 5 November 1980; AMS I.22805-006 (6, 81–119 mm SL) 170 km north of Port Hedland, Western Australia, 18°24'S 118°15'E, 150–156 m, J. Paxton & M. McGrouther, 28 March 1982; CSIRO CA993 (1, 98 mm SL) northeast of Port Hedland, Western Australia, from 18°08'S 119°22'E to 18°07'S 119°21'E 161–173 m, FRV Soela, Frank & Bryce demersal trawl, CSIRO, 12 June 1980; CSIRO CA2188 (1, 102 mm SL) northwest of Admiralty Gulf, Western Australia, from 13°44'S 124°15'E to 13°43'S 124°11'E, 120–121 m, RV Hai Kung, bottom trawl, CSIRO, 28 March 1981; CSIRO CA4072-02 (1, 105 mm SL) north of Port Hedland, Western Australia, from 18°30.6'S 118°43.5'E to 18°31.8'S 118°45.3'E, 145–140 m, FRV Soela, Frank & Bryce demersal trawl, A. Graham & G. Yearsley (CSIRO), 12 June 1980; NMV A2007 (1, 71 mm SL) northwest of Cape Voltaire, Western Australia, from 13°22'S 124°45'E to 124°48'E, 120 m, sand bottom, C.C. Lu, RV Hai Kung, bottom trawl, Cruise 81–HK-2, 29 Mar 1981; NT S12974-003 (5, 82–114) Arafura Sea, Northern Territory, HL90–46, 107–109 m, Helen Larson, 30 Oct 1990; NT S13523-002 (2, 92 & 94) Arafura Sea, Northern Territory, RW92–6, 97–103 m, R. Williams, 18 Sep 1992.

Diagnosis. Dorsal-fin rays XI, 20; anal-fin rays III, 17; pectoral-fin rays 14; tubed lateral-line scales 43; body depth 73.2% in SL; colour light brown, body uniformly pale, head somewhat darker, a dark elongated spot on soft dorsal fin between 2nd and 7th ray, bordered anteriorly by a pale area of similar width, and extending onto membrane between last spine and first ray.

Description. Dorsal fin rays XI, 19–23 (one specimen with X, 25, appears to be aberrant), spines long and broadly compressed near the base, proportionally shortening with growth, length of first spine 6.2–8.8 in SL, length of second spine 13.4–21.0 in SL (more than twice length of first), length of third spine 21.3–35.4 in SL (more than three times length of first), length of fourth spine 25.6–37.1 (usually slightly longer than third), following spines progressively shorter, last spine about equal in length to first soft ray, its length 17.6–23.9 in SL, soft rayed section follows sharp descent of body with gradually and progressively shorter rays; anal-fin rays III, 16–18, its second spine very long,

reaching past third spine when spines depressed and pointing posteriorly, soft section mirroring soft part of dorsal fin; pectoral fin 13–16, usually 15 (36), 14 (10), or 16 (6) and rarely 13 (1); lateral-line scales 37–46, most with 39–41 (c. 60%).

Body deep, 63.6–75% in SL, increasing proportionally with growth, and strongly compressed, 14–19.4% in SL; head profile steep above eye, and large, the length 36.1–42% in SL, shortening proportionally with growth; snout moderately long, its length 28.2–34.6% in HL, shortening proportionally with growth; eye diameter slightly greater than length of snout, 30.1–36.1% in HL, reducing in size proportionally with growth; interorbital narrow, 19.6–27.3% in HL, increasing in width proportionally with growth; caudal peduncle moderately deep, its depth 11.3–14.1% in SL, and short, 4.6–6.4% in SL, the latter shortening proportionally with growth.

Origin of dorsal fin high above posterior end of head, the fin base long, its spinous section deeply incised and the base mostly horizontal, curving gradually downward from last few spines to caudal peduncle with soft section strongly angled downward, and the posterior margin of the fin vertical, base length of spinous and soft section equal in large specimens, soft section slightly shorter than spinous section in small specimens; anal fin directly below soft section of dorsal fin, mirroring its shape; ventral fin with strong spine and filamentous first soft ray.

Body and head covered with large ctenoid scales, gradually becoming smaller on nape and snout, extending far onto the median fins, ventral fin with an auxiliary scale, lateral line with tubed scales, rising at steep angle from origin with about 20 scales in an almost straight line, bending abruptly downward, following contour of soft dorsal fin, ending on caudal peduncle. Largest specimens examined 119 mm SL.

Preserved coloration (in alcohol). Large individuals uniformly pale brown, except for dark spot on soft dorsal fin, accompanied by an anterior pale band. Small individuals have strongly faded banding as described below in colour in life.

Live coloration white overall with three vertical brown to ochre bands, first, about pupil-width, from dorsal origin through eye and over cheek; second from below 4th and 5th dorsal spines, narrowing gradually and reaching to middle of abdomen; and 3rd from below last 3–4 dorsal spines towards caudal peduncle, narrowing and continuing onto anal fin to the end of its first soft ray; all fin spines white; first and second dorsal fin-spine membranes with black pigmentation; a black elongate spot on soft dorsal fin between 2nd and 7–8th rays with a broad white border anteriorly, the white extending ventrally slightly beyond the black, and a submarginal white band in the soft dorsal and anal fins; caudal fin clear with pale ochre basally; soft part of ventral fin brown to dusky ochre with black margin and tip.

Etymology. *australis*, from the Latin, meaning southern, in reference to its southern Hemisphere distribution.

Distribution. *Roa australis* occurs off the northwest coast of Australia. The species ranges from just south of the Rowley Shoals, northwest of Port Hedland, Western Australia to the Arafura Sea, Northern Territory. Specimens were collected between 97 and 173 m depth.



Fig. 1. *Roa australis* n.sp., holotype, WAM P.26215-001 (112 mm SL) off Port Hedland, Western Australia. Photograph by Barry Hutchins.



Fig. 2. left to right. *Roa modesta*. Osezaki, Japan. Depth 20 m. Length 12 cm TL. Photograph by Rudie Kuiter. *Roa jayakari*. Gulf of Aqaba, Red Sea. Depth 180 m. Photograph by Jürgen Schauer, from submersible. *Roa excelsa*. BPBM 24754. Length 98 mm SL. Photograph of preserved specimen and colouring by Rudie Kuiter after Allen *et al.*, 1998.

Table 1. Selected meristic values for species of *Roa*.

	dorsal (XI) soft rays					fin rays anal (III) soft rays			pectoral ^a soft rays				pored scales ^a lateral line									
	19	20	21	22	23	16	17	18	13	14	15	16	37	38	39	40	41	42	43	44	45	46
	<i>Roa australis</i>	1	1	4	18	2	2	16	9	1	10	36	6	6 ^b	3	4	12	7	5	1	1	—
<i>Roa excelsa</i>	—	1	3	—	—	2	2	—	—	6	—	—	4	—	2	2	—	—	—	—	—	—
<i>Roa modesta</i>	—	—	—	3	—	—	3	—	1	5	—	—	—	—	2	1	3	—	—	—	—	—

^a Both sides. A single, apparently aberrant individual, *Roa australis* had D. X, 25.

^b Many specimens have scales missing.

Remarks. The examination of specimens of *Roa australis*, *R. excelsa*, and *R. modesta* show no significant differences in meristic values (Table 1). Published meristic values of *R. jayakari* (Randall, 1995) fall well within the range of its congeners. Morphometric information on *R. jayakari* was obtained from photographs (Allen *et al.*, 1998; Kuitert, 2002). The 4 species show significant differences in morphometrics, but these are complicated by growth changes as shown for 3 of the 4 species (Table 2). Features that are clearly different among species in large specimens do not necessarily differ in small individuals and due to proportional changes with growth, may increase in one species and decrease in another. However colour is markedly different among species (Fig. 2) and diagnostic. Two species, *R. modesta* and *R. jayakari* share similarly marked dorsal fins. Each has a white-edged round ocellus on the soft-rayed section and a mostly black second spine. However, the shape

of the spinous section differs, the profile is evenly round in *R. modesta*, versus virtually straight from the 4th to last spine in *R. jayakari*. *R. modesta* differs from the other 3 congeners in having a ventral broadening of the second dark band and the bands having dark, near black, margins that persist as brown stripes in preservation. *Roa australis* and *R. excelsa* share an elongated black spot on the soft dorsal fin and the black coloration of the second dorsal-fin spine. These two species differ greatly in the width and colour of their dark bands. In *R. australis*, the bands are narrow and do not extend dorsally onto the spines, whereas in *R. excelsa*, the bands are very broad dorsally and almost cover all the dorsal-fin spines, only leaving a small gap of white between the 6th and 8th spine. The species appear to be separated geographically, but distributions are not well understood due to the depths at which *Roa* spp occur.

Table 2. Proportional measurements species of *Roa*. Percentage-range figures are presented respectively to size-range figures, those in italics show a proportional reduction with growth. Those in non-italics show a proportional increase with growth. For each species, n is as per material examined.

	standard length	<i>Roa australis</i> 69.5–119 mm %	<i>Roa excelsa</i> 94–105 mm %	<i>Roa modesta</i> 51.5–97 mm %
body	depth in SL	63.6–75.0	61.0–67.0	66.5–73.2
	width in SL	14.0–19.4	14.9–17.3	15.5–19.3
head	length in SL	<i>42.0–36.1</i>	34.9–37.1	<i>40.9–31.5</i>
snout	length in HL	<i>34.6–28.2</i>	29.3–34.5	<i>32.7–32.5</i>
eye	diameter in HL	<i>36.1–30.1</i>	33.6–32.5	30.8–32.6
interorbital	width in HL	19.6–27.3	25.3–21.7	22.7–27.8
caudal peduncle	depth in SL	11.3–14.1	10.2–11.1	12.0–13.3
	length in SL	<i>6.4–4.6</i>	4.2–4.9	4.6–5.5
caudal fin	length in SL	<i>25.9–21.8</i>	20.0–21.2	<i>25.6–21.1</i>
pectoral fin	length in SL	<i>36.2–29.4</i>	28.8–33.6	<i>30.2–26.3</i>
dorsal-fin base length	spinous in SL	35.8–42.0	<i>40.1–36.4</i>	36.2–38.8
	soft in SL	31.7–42.0	<i>33.9–31.1</i>	35.3–40.8
dorsal-fin spine length	1st in SL	8.8–6.2	7.0–7.7	9.3–6.4
	2nd in SL	<i>21.0–13.4</i>	15.0–17.3	<i>22.3–15.9</i>
	3rd in SL	<i>35.4–21.3</i>	33.9–36.5	<i>30.6–23.4</i>
	4th in SL	<i>37.1–25.6</i>	26.5–32.6	<i>33.7–26.3</i>
dorsal-fin soft-ray length	1st in SL	<i>23.9–17.6</i>	16.6–21.2	<i>23.4–19.5</i>
anal-fin base	length in SL	31.2–37.4	30.6–32.6	36.0–41.8
anal-fin spine length	1st in SL	<i>13.7–9.3</i>	<i>13.2–12.1</i>	9.7–11.9
	2nd in SL	<i>28.1–21.8</i>	<i>30.0–27.1</i>	18.7–19.6
	3th in SL	<i>23.0–18.9</i>	17.2–20.8	19.6–21.9
anal-fin soft-ray	longest in SL	<i>23.2–17.5</i>	18.5–22.3	17.5–26.2
	ventral fin	length in SL	<i>38.1–27.5</i>	33.0–29.9
	spine length in SL	<i>30.2–20.3</i>	26.0–23.6	22.3–25.8

Other material examined. *Roa excelsa*: BPBM 10867 (1, 71 mm SL) Oahu, Hawaiian Islands, 80 fathoms, Otter trawl, Robert Cordover, 25 March 1971; BPBM 10868 (1, 94 mm SL) Oahu, Hawaiian Islands, 75 fathoms, gill net, Thomas Clarke, 19–20 April 1971; BPBM 24754 (1, 105 mm SL) Oahu, Hawaiian Islands, 21°39'N 158°06'W 180–200 m, shrimp trawl, “Townsend Cromwell”, cruise 61, station 26, 17 October 1972; BPBM 24827 (1, 71 mm SL) Oahu, Hawaiian Islands, 21°39'N 158°06'W 180–200 m, shrimp trawl, “Townsend Cromwell”, cruise 61, station 32, 18 October 1972.

Roa modesta: NT S12725-014 (1, 51.6 mm SL) Wakasa Bay, Japan, 35°30'N 135°45'E, trawl, I. Nakamura, 10 November 1988; WAM P.30260-002 (2, 86 & 97 mm SL) western Wakasa Bay, Japan, 35°30'N 135°45'E, trawl, I. Nakamura, 10 November 1988.

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